

## PG&E Safe Harbor Baseline Study on Tulare Hill

Stuart B. Weiss, Ph.D.  
27 Bishop Lane  
Menlo Park CA 94025

July 2006

### Introduction

The purpose of this study is to document baseline conditions for the Safe Harbor Agreement (SHA) between PG&E and the US Fish and Wildlife Service (FWS) regarding management of the PG&E transmission line corridor across Tulare Hill, San Jose, CA. The main objective is to document the composition of serpentine grassland vegetation in 2006 as baseline conditions.

As noted in the proposal, the deliverable products are:

1. A quantitative vegetation assessment including the following eight vegetation cover categories: % dwarf plantain (*Plantago erecta*), % owl's clover (*Castilleja* spp.), % cream cups (*Platystemon californicus*), % nectar sources (*Lasthenia californica*, *Lomatium* spp., and *Layia platyglossa*, *Muilla maritima*, *Allium serratum*), % exotic grasses, % all other plant species, % bare ground, and % rock.
2. Photographic plots at each transect, and presented in the report. Plots may be revisited annually to record changes in vegetation composition.

### Methods

Thirteen permanent 50-m transects were installed, with ten 0.5-m<sup>2</sup> quadrats placed at five meter intervals along each transect. Transect ends were marked with rebar capped with PVC pipe. Percent cover of each species (plus characters such as rock and bare ground) were recorded in the following cover classes: 1, 2, 5, 10, 20, 30, 40, etc. These cover classes have worked well in other studies of serpentine grassland, such as those done for the Metcalf Energy Center (MEC) Ecological Preserve, for monitoring the large changes that are characteristic of serpentine grassland, and are sensitive enough to detect undesirable and desirable changes in plant community composition. This peer-reviewed method (Hobbs and Mooney 1995) is robust enough to accurately depict this parcel's baseline conditions if no other monitoring is completed. Additionally, the permanent transects allow for statistically powerful comparisons if further monitoring is required in the future.

Transects were stratified along topographic and edaphic gradients, including insolation, topographic position, geomorphology, and the May 2004 burn line, similar to the design used in MEC monitoring reports. This stratification accounts for variability among plots and samples the full range of spatial variability on the parcel. Insolation strata are based on March 21 potential clear-sky insolation - VW = Very Warm (>19 MJ m<sup>2</sup> d<sup>-1</sup>), W = Warm (17.5-19 MJ m<sup>2</sup> d<sup>-1</sup>), M = Moderate (15-17.5 MJ m<sup>2</sup> d<sup>-1</sup>), C = Cool (14-15 MJ m<sup>2</sup> d<sup>-1</sup>) and VC = Very Cool (<14 MJ m<sup>2</sup> d<sup>-1</sup>). These strata were also used in the MEC Ecological Reserve report (Weiss 2004). These insolation strata are the basis for stratified sampling of postdiapause larvae, and the insolation gradient has a profound effect on larval growth rates and hostplant phenology (Weiss et. al 1988). Vegetation shows strong compositional changes across the thermal gradient.

Note that some ambiguity in the insolation strata as mapped is unavoidable, because the 10 meter grid of the digital elevation model (DEM) and the serpentine map (provided by Robert Colman) do not always agree with field observations at a fine scale. Topographic position ranges from ridgetops to slopes to the base of slopes, and the swale bottom near the middle of the parcel was its own stratum because of difference in soil type. Once the strata were defined, the initial point for each transect were chosen by a randomization of distance and direction (using random numbers) from an arbitrary point within the stratum, constrained by the need to remain within the selected environment.

The following species and groups of species were summarized: % dwarf plantain (*Plantago erecta*), % owl's clover (*Castilleja* spp.), % cream cups (*Platystemon californicus*), % nectar sources (*Lasthenia californica*, *Lomatium* spp., and *Layia platyglossa*, *Muilla maritima*, *Allium serratum*), % exotic grasses, % all other plant species, % bare ground, and % rock.

Figure 1 shows the position of transects, and Table 1 provides the GPS coordinates of the transect ends. Figure 2 are photographs taken from the A end of each transect. Figure 3 is the graphical presentation of plant cover. Table 2 provides a the numbers for transects, and means for

Eight transects were in the May 2004 burn area (from W1 east), and five were outside (Figure 1). Quantitative analyses of the effects of the 2004 burn are beyond the scope of this report, and require consideration of the entire 2006 Tulare Hill data set. But qualitative comparisons will be made where appropriate.

The results for the PG&E transects are briefly compared to the 2005 results across a range of grazing and fire regimes. The 2006 data for those areas has not yet been compiled for presentation.

### **Plant Composition (Figure 3 and Table 2)**

*Plantago erecta*: Mean cover was 10.3% and ranged from 1 to 30% among transects. *Plantago* cover is higher than that on winter-spring and summer fall grazed sites on Coyote Ridge in 2005 (CR W-S, and CR S-F) and falls within the higher end of the historical range of variability at Coyote Ridge (Weiss and CH2M Hill 2004).

*Castilleja* spp.: Mean cover was 0.1 %, ranging from 0 to 0.6% among transects and was found on only 4 transects. *Castilleja* is very patchily distributed and highly variable from year to year

Nectar sources: Mean cover was 3.2%, ranging from 0 to 14% among transects. *Lasthenia* was the dominant nectar plant. *Muilla* and *Allium* were present in low abundance, *Lomatium* spp. was not present in transects but found on property, and *Layia* was absent. Nectar source cover was lower than CR W-S, but comparable to CR S-F and similar to the burned and grazed portions of Tulare Hill in 2005.

*Platystemon californicus*: This plant was not encountered in the quadrats, but is scattered as individuals across the property. The largest numbers were qualitatively noted near Transect M3.

Exotic Grasses: Mean cover was 41.8%, ranging from 25% to 70% among transects. Exotic grass cover was greater than on CR W-S, similar to that on CR S-F, but lower than that in ungrazed – unburned areas.

Other plants: Mean cover was 16%, and ranged from 6 to 25% among transects.

Bare ground: Mean cover was 11%, and ranged from 1.5% to 25% among transects.

Rock: Mean cover was 10%, and ranged from 0 to 25% among transects.

Thatch: Mean cover was 8.25%, and ranged from 0.5 to 27% among transects. The greatest thatch cover was on the swale transect.

### **Bay checkerspot butterfly observations**

Tulare Hill is still occupied by breeding Bay checkerspot butterflies, but the population is small (likely <100 individuals). One postdiapause larva was found on the MEC Ecological Preserve in February 2006. One adult was observed on the PG&E property near transect C2 on April 21, 2006.

### ***Dudleya setchellii* observations**

While *Dudleya* surveys were not part of the scope of work, populations of *Dudleya* were noted in the following areas;

- 1) A small population near the towers east of Transect M4
- 2) Rock outcrops north of Transect W2
- 3) Road cut north of Transect VC2
- 4) Scattered individuals on rock outcrops Transects VC1 and VW2.

### **Plant species lists**

Plant species lists (botanical names only) for the quadrats (75 species total, Table 3) and a partial list for the parcel as a whole (89 species) are included.

### **Interpretation**

The 2006 plant composition of the PG&E parcel documents that substantial areas of high quality Bay checkerspot butterfly habitat are present on the parcel, despite the lack of grazing since 2001. Larval hostplants and adult nectar sources are present in patches of high abundance, but are relatively low density on many Cool and Very Cool slopes that provide core habitat for the butterfly.

It is estimated that Tulare Hill receives 15-20 kg-N ha<sup>-1</sup> year<sup>-1</sup> from atmospheric deposition (Weiss 2004). In combination with the wetter than average growing seasons in 2005 and 2006, this fertilization has resulted in the dense swards of annual grass in the absence of grazing.

The high quality habitat remaining is largely the result of the May 2004 burn. Ungrazed-unburned areas on Tulare Hill and on Coyote Ridge lose *Plantago* cover as exotic grasses invade and dominate. Lodged stands of annual grass and thick thatch covered much of the ungrazed-unburned habitat on Tulare Hill in 2005 and 2006, and *Plantago* and *Lasthenia* (and other native forbs) were mostly restricted to lenses of very thin soil (~5 cm). These areas will be slow to recover, since they

have been degraded for several years and few native annual forbs survive in the lodged stands of grass. Burned and ungrazed areas on Tulare Hill have maintained high *Plantago* cover, but grasses are vigorously re-invading. However, these areas produced a crop of native annual seed in 2006 and should improve rapidly with the reintroduction of grazing.

### **References**

Hobbs, R.J., and H.A. Mooney. 1995. Spatial and temporal variability in California annual grassland: results from a long-term study. *Journal of Vegetation Science* 6:43-56.

Weiss, S.B. 2004. Annual monitoring report for the Metcalf Energy Center Ecological Preserve. CH2M Hill, Sacramento, CA.

Weiss, S.B., D.D. Murphy, and R.R. White. 1988. Sun, slope and butterflies: topographic determinants of habitat quality for *Euphydryas editha*. *Ecology* 69:1486-1496.

Weiss, S.B., and D. Wright. 2005. Serpentine Vegetation Management Project 2005 Report. FWS Grant Agreement No. 814205G240, Sacramento, CA

Figure 1 Map. Units are UTM NAD 83 meters. Transects are arrows going from A end to B end (see Table 1). Thermal classes are coded: Red = Very Warm, Yellow = Warm, Green = Moderate, Cyan = Cool, Blue = Very Cool. Note that serpentine map is not entirely accurate; Transects VC2 and Swale are in serpentine soils. The Burn area from May 2004 is stippled with a black outline.

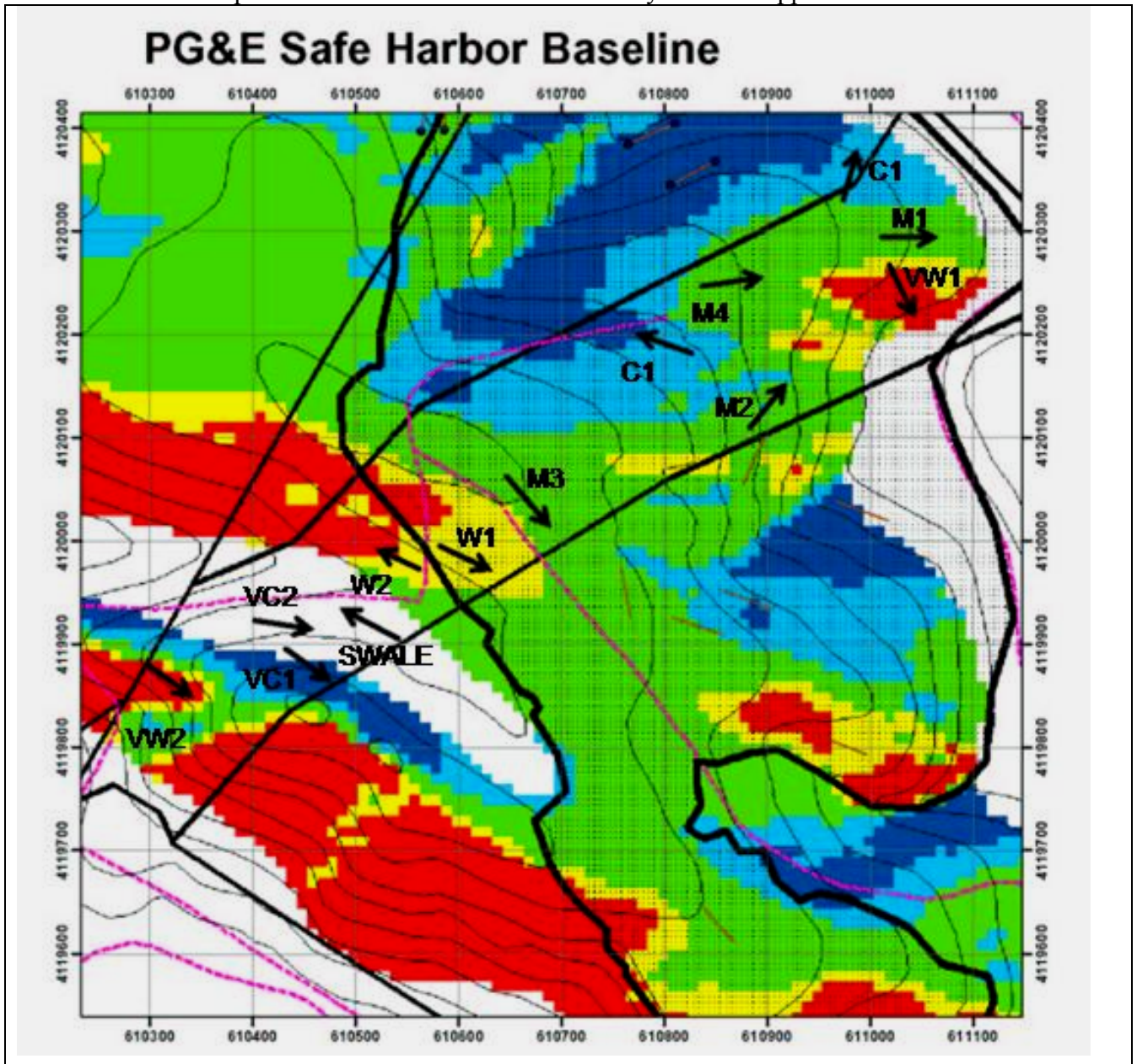


Figure 2. Photo plots taken from “A” end of transect April 18 – 24 2006.

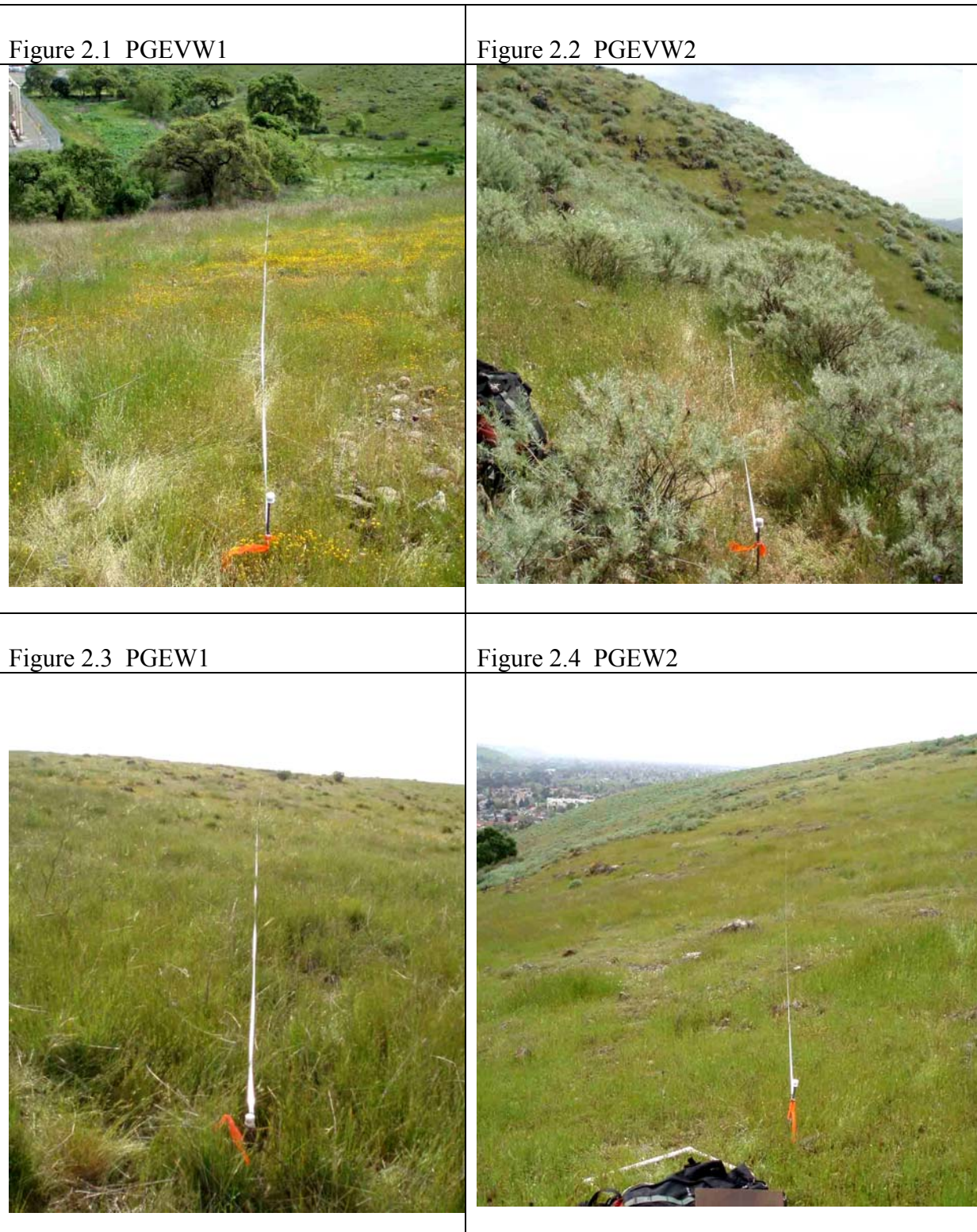


Figure 2.5 PGEM1



Figure 2.6 PGEM2



Figure 2.7 PGEM3



Figure 2.8 PGEM4

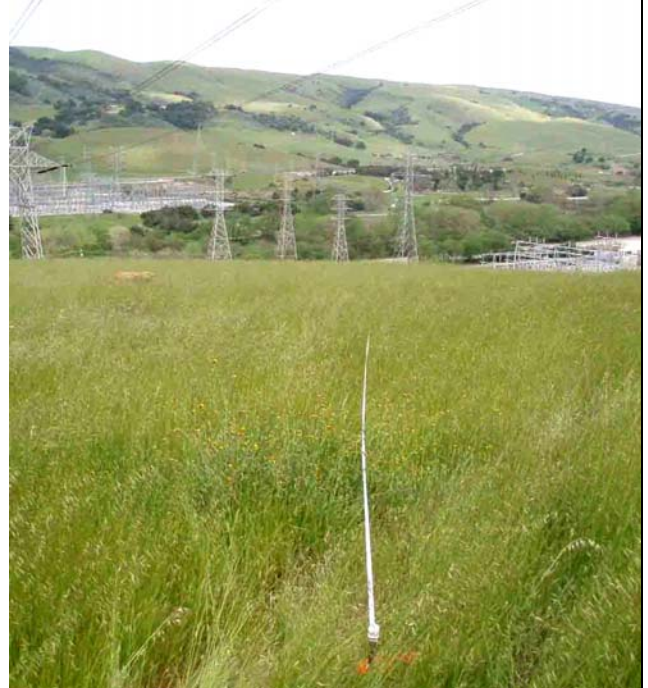


Figure 2.9 PGEC1

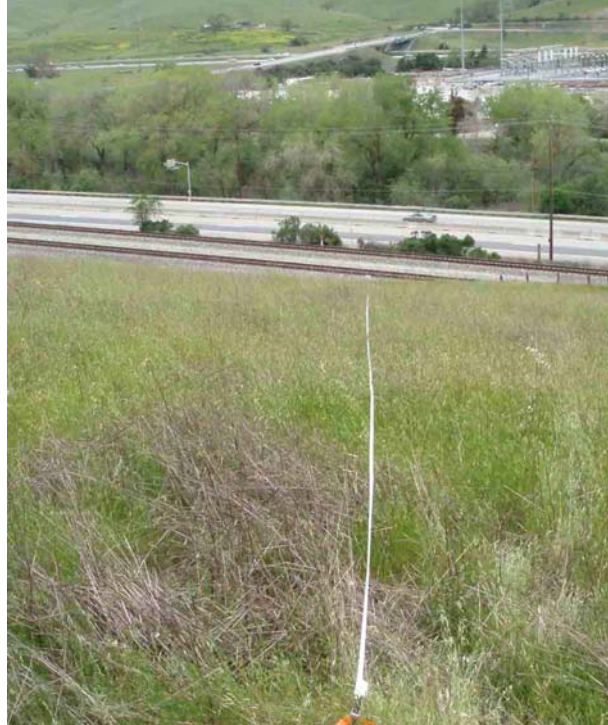


Figure 2.10 PGEC2



Figure 2.11 PGEVC1



Figure 2.12 PGEVC2



Figure 2.13 PGESWALE1	
 A photograph of a grassy hillside. In the foreground, a white measuring tape is stretched vertically through tall green grass. A small white tag is attached to the tape near the bottom. In the background, there are some dark green bushes or small trees on a slope under a cloudy sky.	

Figure 3.1

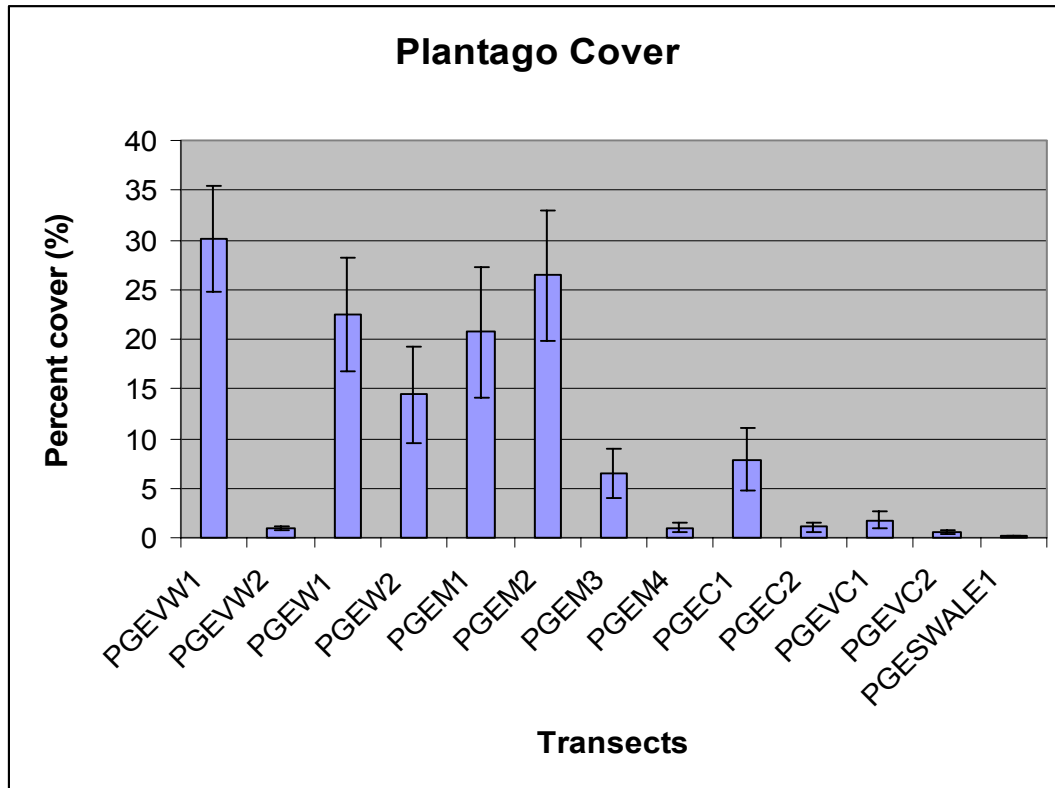


Figure 3.2

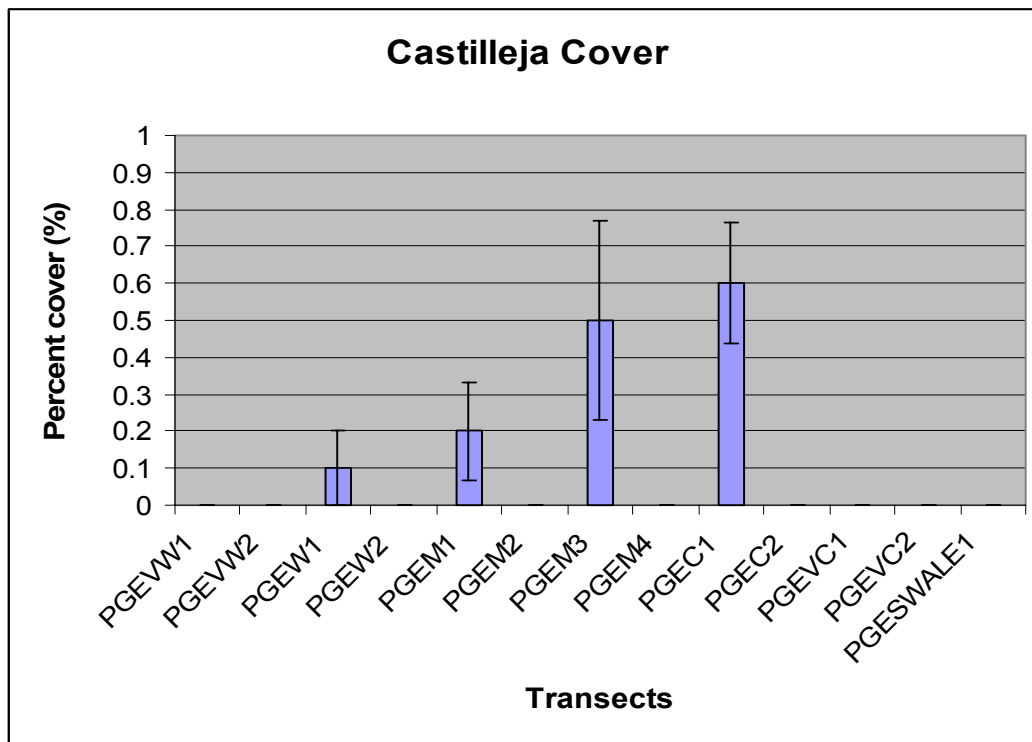


Figure 3.3

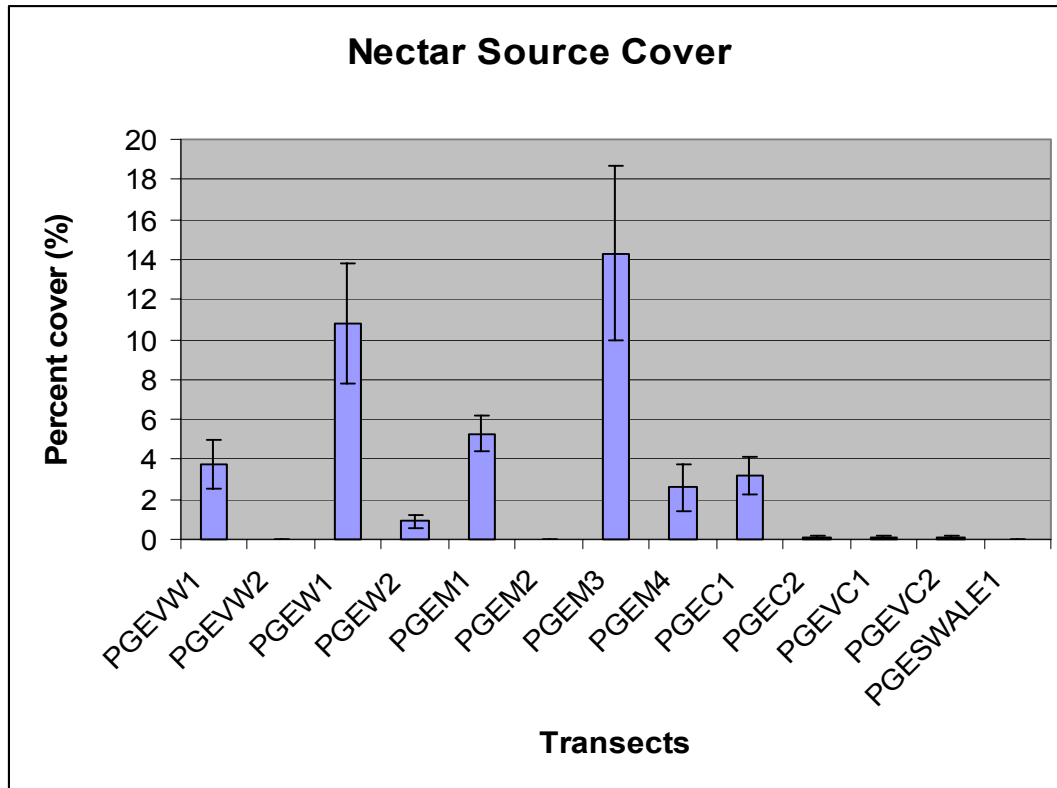


Figure 3.4

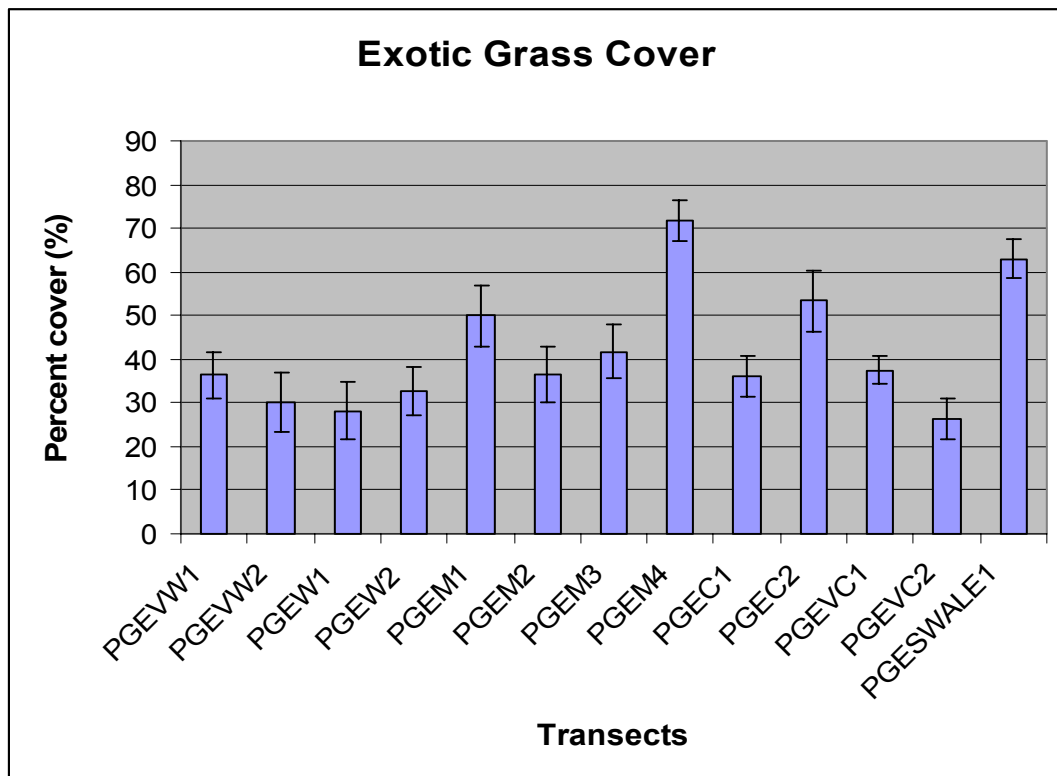


Figure 3.5

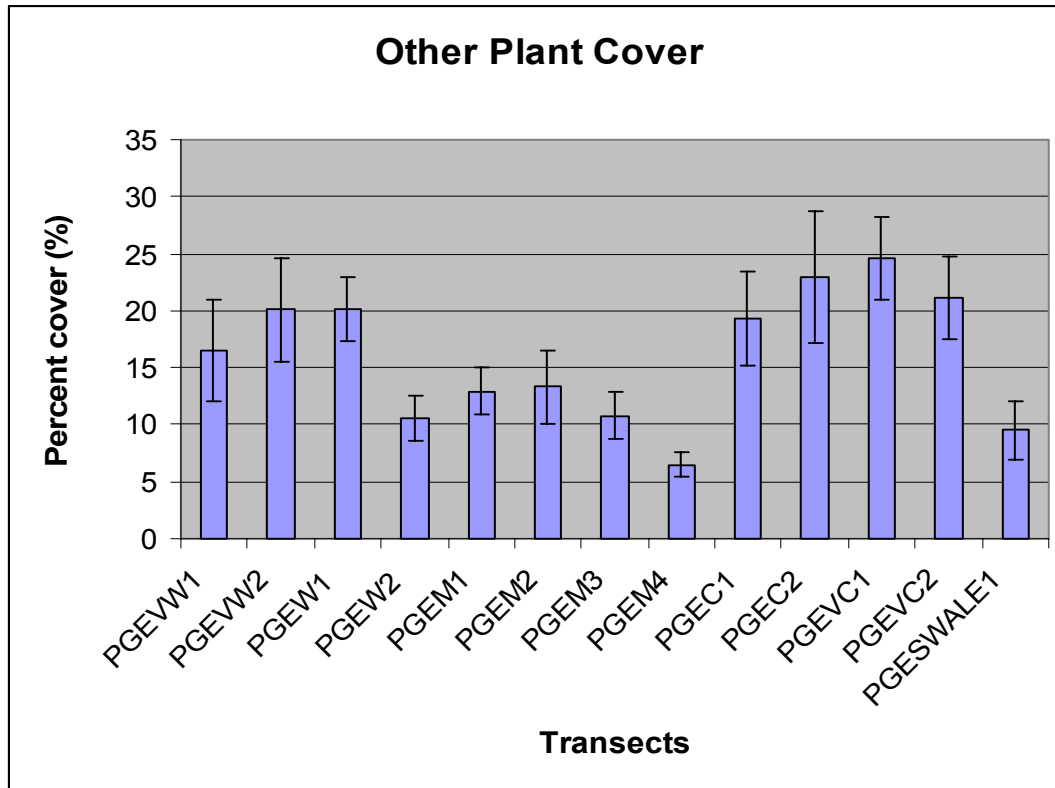


Figure 3.6

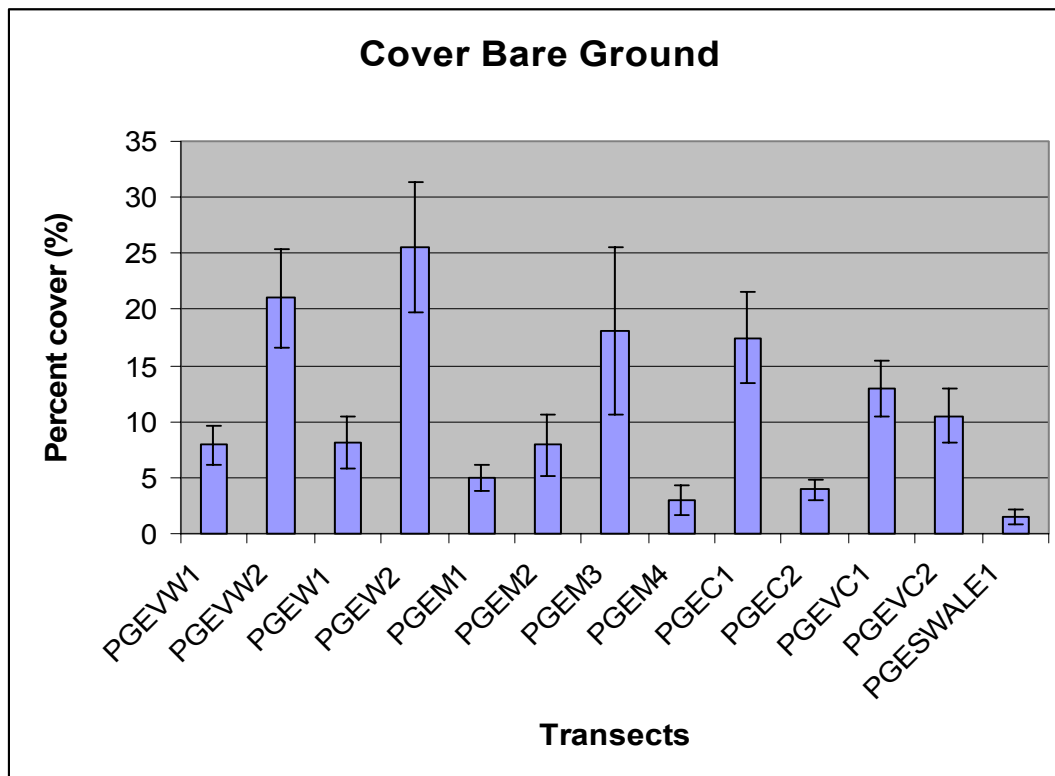


Figure 3.7

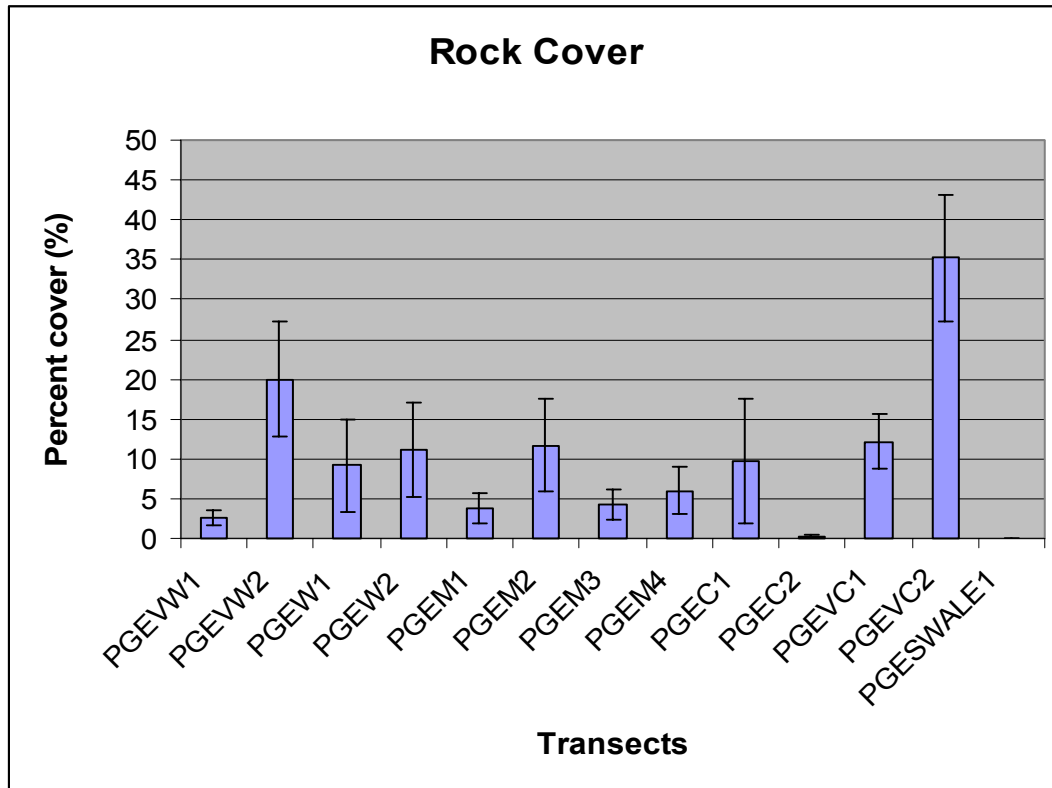
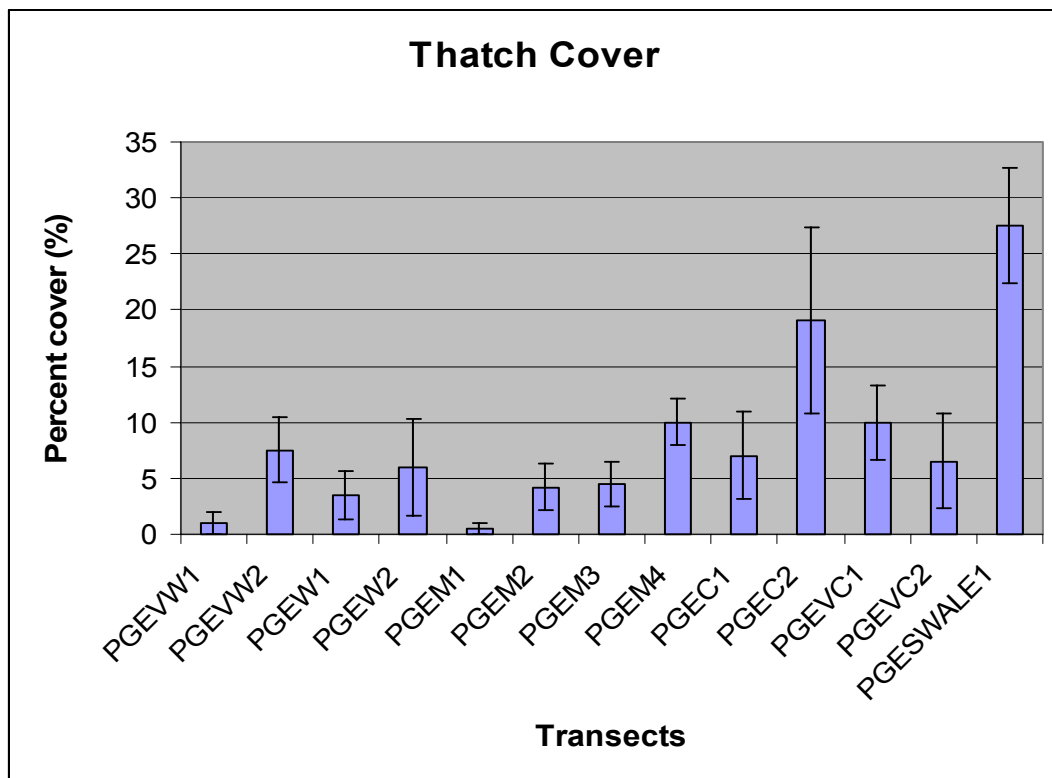


Figure 3.8



No Platystemon was found in plots.

Table 1 GPS coordinates of transect ends UTM NAD 83 Zone 10S

Transect	Easting	Northing	Date
PGEVW1A	611011	4120281	4/17/2006 16:59
PGEVW1B	611028	4120234	4/17/2006 17:07
PGEVW2A	610304	4119895	4/17/2006 20:56
PGEVW2B	610343	4119860	4/17/2006 21:01
PGEW1A	610582	4120009	4/17/2006 18:09
PGEW1B	610622	4119980	4/17/2006 18:12
PGEW2A	610553	4119978	4/17/2006 18:24
PGEW2B	610512	4119999	4/17/2006 18:28
PGEM1A	611010	4120317	4/17/2006 16:39
PGEM1B	611058	4120311	4/17/2006 16:45
PGEM2A	610880	4120110	4/17/2006 17:25
PGEM2B	610900	4120156	4/17/2006 17:32
PGEM3A	610651	4120061	4/17/2006 17:54
PGEM3B	610684	4120024	4/17/2006 17:55
PGEM4A	610836	4120273	4/17/2006 22:55
PGEM4B	610886	4120273	4/17/2006 22:57
PGEC1A	610989	4120356	4/17/2006 16:30
PGEC1B	610998	4120406	4/17/2006 16:35
PGEC2A	610808	4120186	4/17/2006 17:37
PGEC2B	610644	4120058	4/17/2006 17:52
PGEVC1A	610440	4119892	4/17/2006 19:34
PGEVC1B	610488	4119890	4/17/2006 19:38
PGEVC2A	610358	4119921	4/17/2006 22:16
PGEVC2B	610407	4119926	4/17/2006 22:18
PGESWALE1A	610554	4119911	4/17/2006 22:27
PGESWALE1B	610507	4119932	4/17/2006 22:28

Table 2. Comparisons among sites

<b>Transect</b>	<b>Plantago</b>	<b>Castilleja spp.</b>	<b>Nectar sources</b>	<b>Exotic grasses</b>
PG&E 2006	10.3	0.1	3.2	41.8
CR W-S 2005	7.9	0.2	10.1	23.8
CR S-F 2005	7.5	0.1	3.8	44.8
CR UG 2005	4.1	0.04	1.0	64.3
TH UB-UG 2005	2.1	0	1.7	72.1
TH B-UG 2005	15.8	0.6	3.3	33.3
TH B-G 2005	16.7	0.2	4.6	24.5

**Site Codes:**

CR W-S: Winter-Spring grazing, ~1 cow-calf/10 acres. Kirby Canyon Butterfly Trust Area

CR S-F: Summer-Fall grazing, ~ 1 cow-calf/10 acres. UTC and Los Esteros mitigation parcel

CR UG: Ungrazed within Kirby Canyon Landfill Lease

TH UB-UG: Unburned-Ungrazed- on Whisky Hill Associates

TH B-UG: Burned-Ungrazed on Whisky Hill Associates

TH B-G: Burned-Grazed on MEC Ecological Preserve (Spring grazing)

Table 3. Species list of vascular plants found in plots. Non-native species are noted with \*.

Achillea millefolium  
Agoseris heterophylla  
Allium serra  
Amsinckia menziesii var. intermedia  
Aphanes occidentalis  
Artemisia californica  
Astragalus gambelianus  
Athysanus pusillus  
Avena sp.\*  
Brodiaea sp.  
Bromus hordeaceus ssp. Molliformis\*  
Bromus madritensis ssp. Rubens\*  
Bromus trinii\*  
Calandrinia ciliata  
Calystegia subacaulis  
Castilleja densiflora  
Chlorogalum pomeridianum  
Claytonia gypsophiloides  
Claytonia perfoliata  
Crassula connata  
Cryptantha flaccida  
Daucus pusillus  
Delphinium hesperium  
Deschampsia danthonioides  
Dichelostemma capitatum  
Dodecatheon hendersonii  
Dudleya setchellii  
Elymus multisetus  
Epilobium sp.  
Eriogonum nudum  
Eriogonum sp.  
Eriophyllum confertiflorum  
Erodium cicutarium\*  
Eschscholzia californica  
Euphorbia spathulata  
Galium aparine  
Galium porrigens  
Gilia achilleifolia  
Gilia tricolor  
Hemizonia congesta  
Hesperis matronalis  
Hordeum murinum ssp. Leporum\*  
Koeleria macrantha  
Lactuca sp.\*  
Lamarckia aurea\*  
Lasthenia californica  
Lepidium nitidum  
Lessingia nemaclada

Lolium multiflorum\*  
Lotus wrangelianus  
Lupinus bicolor  
Melica californica  
Melica sp.  
Micropus californicus  
Microseris douglasii ssp. douglasii  
Muilla maritime  
Nassella pulchra  
Plantago erecta  
Poa secunda  
Poaceae sp.  
Pterostegia drymarioides  
Ranunculus californicus  
Rigiopappus leptocladus  
Sanicula bipinnatifida  
Silene gallica\*  
Sisyrinchium bellum  
Stellaria media  
Trifolium depauperatum  
Trifolium gracilentum  
Trifolium microdon  
Trifolium sp.  
Trifolium willdenovii  
Triteleia laxa  
Vulpia microstachys  
Vulpia myuros\*

Table 4. Incomplete species list of vascular plants found on PG&E property at Tulare Hill. Non-native species are noted with \*.

Achillea millefolium  
Agoseris heterophylla  
Allium serra  
Amsinckia menziesii var. intermedia  
Aphanes occidentalis  
Artemisia californica  
Astragalus gambelianus  
Athysanus pusillus  
Avena sp.  
Brodiaea sp.  
Bromus diandrus\*  
Bromus hordeaceus ssp. Molliformis\*  
Bromus madritensis ssp. Rubens\*  
Bromus trinii\*  
Calandrinia ciliata  
Calystegia subacaulis  
Carduus pycnocephalus  
Castilleja densiflora  
Centaurea calcitrapa\*  
Chlorogalum pomeridianum  
Claytonia gypsophiloides  
Claytonia perfoliata  
Crassula connata  
Cryptantha flaccida  
Daucus pusillus  
Delphinium hesperium  
Deschampsia danthonioides  
Dichelostemma capitatum  
Dodecatheon hendersonii  
Dudleya setchellii  
Elymus multisetus  
Epilobium sp.  
Eriogonum nudum  
Eriogonum sp.  
Eriophyllum confertiflorum  
Erodium botrys\*  
Erodium cicutarium\*  
Eschscholzia californica  
Euphorbia spathulata  
Foeniculum vulgare\*  
Galium aparine  
Galium porrigens\*  
Gilia achilleifolia  
Gilia tricolor  
Hemizonia congesta  
Hesperis matronalis  
Hordeum brachyantherum  
Hordeum murinum ssp. leporinum

Koeleria macrantha  
Lactuca sp.\*  
Lamarckia aurea\*  
Lasthenia californica  
Lepidium nitidum  
Lessingia nemaclada  
Lolium multiflorum\*  
Lotus wrangelianus  
Lupinus bicolor  
Lupinus albifrons var. collinus  
Marrubium vulgare\*  
Medicago polymorpha  
Melica californica  
Melica sp.  
Micropus californicus  
Microseris douglasii ssp. douglasii  
Muilla maritime  
Nassella pulchra  
Pentagramma triangularis  
Plantago erecta  
Platystemon californicus  
Poa secunda  
Poaceae sp.  
Pterostegia drymarioides  
Ranunculus californicus  
Rhamnus tomentella ssp. tomentella  
Rigiopappus leptocladus  
Rumex crispus  
Sambucus mexicana  
Sanicula bipinnatifida  
Silene gallica\*  
Sisyrinchium bellum  
Stellaria media\*  
Trifolium depauperatum  
Trifolium gracilentum  
Trifolium microdon  
Trifolium sp.  
Trifolium willdenovii  
Triteleia laxa  
Vulpia microstachys  
Vulpia myuros\*